The CORRELATION of RECENT and FOSSIL TURRITELLIDAE of SOUTHERN AUSTRALIA

By BERNARD C. COTTON, Conchologist, S.A. Museum, and
NELLY HOOPER WOODS, M.A.

Fig. 1-9.

Continual reference has been made to the generic and specific confusion which exists among the *Turritellidae* of Southern Australia, particularly in so far as the fossils are concerned. In this paper an effort is made to clarify some of the problems which have been most acute in the identification of certain species, and to determine the generic or sub-generic location of both the recent and fossil species.

We retain the genus *Turritella*, of which the genotype *T. terebra* is an Australian shell, reducing many so-called genera to sub-generic status. Examination of the genotypes of *Haustator*, *Gazameda*, and *Maoricolpus* has led us to regard the latter two as distinct sub-genera of *Turritella* and not as synonyms of *Haustator* as Thiele (1) has suggested.

Our grateful thanks are due to Dr. H. J. Finlay, whose notes first gave the impetus to the preparation of this paper; to Mr. F. A. Singleton for the very generous loan of material from his collection and notes he had prepared; and to Mr. F. Chapman and Miss I. Crespin for permission to examine material in the Commonwealth Palaeontological Collection.

Turritella Lamarck 1799.

Only one species of *Turritella* s.s., *Turritella terebra*, the genotype (by monotypy), occurs in Australia, and this species was included by Hedley (2), in his list of Western Australian mollusca. We now describe a distinct subspecies:

T. terebra occidua subsp. nov.

Shell turreted, fairly thin; whorls ventricose; spirals regular but weak, with intermediate finer spiral lirae; suture linear, aperture rotund. Growth striae very fine and regular, corresponding to the concave outer lip of aperture. Colour varying from light to medium brown, occasionally axially flamed with white.

(1) Handbuch der Systematischen Weichtierkunde, Erster Tiel, 1929, p. 181.

(2) Hedley, Mollusca of Western Australia, Roy. Soc., W. Aust., i, 1916, p. 1.

Holotype. Length 22 mm., width 6 mm. King George's Sound, 12-14 fathoms. Reg. No. D. 11439 S.A. Museum. Also from King George's Sound, 28 fathoms. Hopetoun 35 fathoms.

All specimens examined are broken, including the holotype, which if complete, would be of greater length.

KIMBERIA subgen. nov.

Shell with no outer lip sinus, a three-whorled apex and spiral cords with or without a carina.

Type. *Turritella kimberi* Vereo.

T. neptunensis Vereo and probably *T. microscopica* May should be placed here.

The three species are related to the New Zealand *T.* (*Eglisia*) *planostoma* Hutton, ([3]) which Finlay ([4]) has referred to *accisa*, but this has a different apex and base. They are certainly not *T.* (*Striacolpus*) Finlay with its marked sinus and one-whorled apex, but seem to form a distinct group recalling the true tropical *Turritella* which is a large shell, *Kimberia* being very small.

MAORICOLPUS Finlay.

TURRITELLA MURRAYANA Tate.

Torcula murrayana Tate, Proc. Roy. Soc., Tas., 1884, p. 227.

Turritella murrayana Tate, Trans. Roy. Soc., S. Aust., xvii, p. 340, pl. viii, fig. 3.

In his original description, though the name is suggestive, Tate has not made the locality of the type clear. However, he has distinctly marked as type a tablet of specimens from the River Murray Cliffs. From measurements, the central shell on the tablet (in the Tate Museum Collection) is the holotype, of which a considerable portion of the apex is missing, and the length of 60 mm. is that of the shell as it remains without the initial 4 or 5 whorls which would contribute at least 5 mm. in additional length.

There are two distinct species which have been classified under *T. murrayana*. Since both the slender and the stout forms occur together at several localities, notably Table Cape and Mornington, we deem it advisable to describe the stout form as a new species. The holotype of *murrayana* is of the slender variety, and the slightly more slender shells occurring at Shelford are readily associated

([3]) Trans. N.Z. Inst., xvii, 1885, p. 320, pl. xviii, fig. 19.

([4]) Trans. N.Z. Inst., lx, 1929, p. 41.

with the Murray examples. The true *murrayana* is found, though rarely, at Table Cape, and it does appear to grow to the extremely large size of the stouter species. Two of the shells on Tate's block of Table Cape specimens are *murrayana*, the rest are the gross form.

An Upper Pliocene development of *T. murrayana* is found in the Abattoirs Bore, Adelaide, which is here described as a new subspecies.

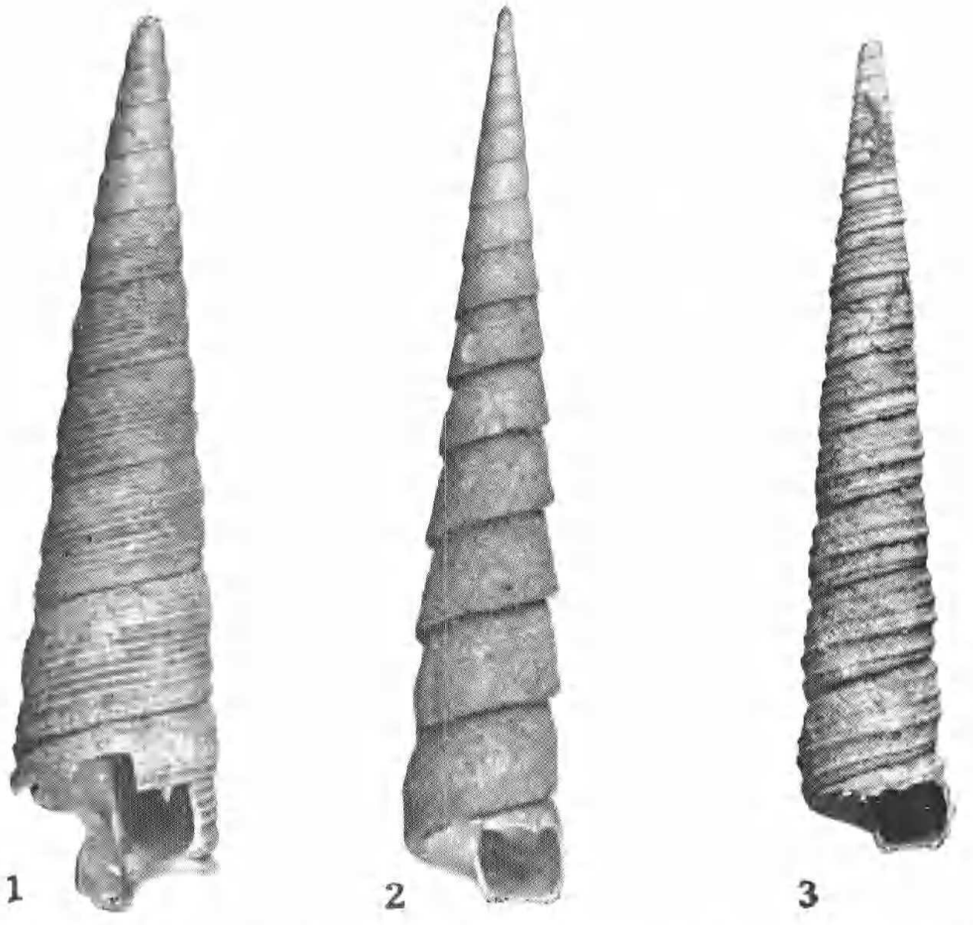

Fig. 1. *Turritella murrayana subrudis* subsp. nov. (× 1·9). Fig. 2. *Turritella acricula adelaidensis* subsp. nov. (× 2·6). Fig. 3. *Turritella subacricula* sp. nov. (× 2·2).

TURRITELLA MURRAYANA SUBRUDIS subsp. nov.

Shell having general characteristics of *T. murrayana;* apical angle 15° ; but possessing much flatter whorls, less inflation in the early whorls and less carination at the anterior suture; very strong, coarse spiral sculpture.

Holotype, of which the early whorls are broken. Length 49 mm., width 12 mm. Abattoirs Bore 300-500 ft. (Upper Pliocene). Tate Mus. Coll.

TURRITELLA LATISSIMA sp. nov.

Torcula murrayana var. Tate, Proc. Roy. Soc., Tas., 1884, p. 227.
Turritella murrayana var. Tate, Trans. Roy. Soc., S. Aust., xvii, p. 340.

Shell stout, turreted, apical angle 21°. Protoconch absent, ten whorls remaining, first whorls inflated, later medially slightly concave. Sculpture consists of 24 even, spiral, thread-like ribs crossed by evenly-developed growth lines. Aperture broken, apparently sub-quadrate with fairly deep sinus indicated by lines of growth.

Holotype. Length 65 mm., width 21·5 mm. Table Cape. Lower Miocene.

Remarks: The difference in apical angle and the less strongly developed carination at the anterior border make this species easy to separate from *T. murrayana*. Specimens from Mornington show early whorls very convex, later whorls only slightly flattened, surface sculpture of about 14 threads with growth lines less prominently developed.

A gerontic specimen from Table Cape has measurements: length 82 mm., width 28 mm.

STIRACOLPUS Finlay.

T. (*Stiracolpus*) Finlay 1926 includes the Australian *T. godeffroyana* Donald, *T. smithiana* Donald, *T. atkinsoni* Tate and May, and the closely-allied *T. medioangulata* Vereo; in New Zealand *Stiracolpus* seems to be directly derived from *Zeacolpus* as a late Pliocene offshoot, so that it is doubtful whether any Australian shells belong to it. Certainly no other Australian species than these four could be located there. For the present, *Stiracolpus* must be admitted as common to the Commonwealth and Dominion.

GAZAMEDA Iredale 1924.

Distinguished by the long spire, narrow spire angle, and frequent carination in the anterior suture, flatly convex base with rounded periphery, *Gazameda* includes *T. gunnii* Reeve (genotype), *T. septifraga* Tate, *T. acricula* Tate, *T. subacricula* sp. nov., *T. tasmanica* Reeve, *G. iredalei* Finlay, and *T. multicincturalis* Chapman and Crespin.

These represent the *Zeacolpus* of New Zealand, having a similar apex and sculpture variations (the sudden straight spire margins are peculiar to some species of *Gazameda* and foreign to *Zeacolpus* with its notably convex whorls with deep sutures for a long way down the spire, though adult whorls are flattish), though the protoconch is more regularly coiled and smaller.

There is no relation, as has been suggested by Cotton and Godfrey (5) between *Stiracolpus* Finlay and *G. iredalei* Finlay. The development of two strong keels in that species appears to be foreign to *Gazameda*, but is paralleled in *Zeacolpus* by *Z. fulminata* Hutton, while *T. pagoda* Reeve and *T. ahiparana* Powell have only one strong keel, yet all are easily connected with *T. vittata* Hutton, and obviously recent offshoots from it. It is well known that the strong keels develop sporadically in many groups of *Turritellidae*. It appears then that *G. iredalei* Finlay represents exactly the same offshoot from *Gazameda* that *T. fulminata* is from typical *Zeacolpus*. The apical development of *G. iredalei* does not seem to differ much from that of *T. tasmanica* Reeve as indeed Vereo (6) stated, and is unlike that of *T. symmetrica* Hutton. The *Gazameda* series outlined here also differs notably from *Zeacolpus* in the shape of the aperture and the flatly convex base with rounded periphery.

TURRITELLA ACRICULA Tate.

Turritella acricula Tate, Trans. Roy. Soc. S. Aust., xvii, p. 339. pl. viii, fig. 4, pl. ix, fig. 4, 7, 12.

This species, while it has not presented the difficulties in identification experienced with other species of *Turritella*, is a very puzzling one in view of the striking variations in specimens from different localities. So marked are these peculiarities that at times one is tempted to conclude that none of the shells from other localities are conspecific with the holotype from the Murray Cliffs. The species as a whole is also so closely related to *T. tasmanica* Reeve (= *T. subsquamosa* Dkr., = *T. acula* T. Woods, etc.) that it is with difficulty that one decides whether some of the Victorian and Tasmanian shells are more closely related to the South Australian fossil species than to the recent *T. tasmanica*.

The holotype is undoubtedly a distinct species from the recent shell; it is, as Tate says, relatively narrower; it is more flattened in the whorls and much more acuminately turreted, while the tendency is to become more separate at the suture as the shell advances in age. We therefore advise the retaining of the fossil species *T. acricula* as distinct.

The position of the Victorian and Tasmanian shells is then to be decided. It is obviously unwise to make decisions on the evidence of isolated shells bearing a more striking resemblance to one species than to the other, in view of the fact that the Tertiary species is probably an ancestor of the recent. We have therefore endeavoured to obtain an average of the specimens under our observation from the Tate Collection and that of Mr. F. A. Singleton. The accompanying table is the result of our calculations.

(5) S.A. Nat., xii (iv), p. 59, pl. 2, fig. 4.

(6) *Trans. Roy. Soc., S. Aust.*, xxxiv, 1910, p. 119.

TABLE SHOWING COMPARISON OF SUBSPECIES OF *TURRITELLA ACRICULA*.

Shell.	Locality.	Age.	Average Length in mm.	Average Width in mm.	Average Index $\frac{L}{W}$	Thickness of Shell.	No. of Spiral Ribs (penultimate whorl) Major	No. of Spiral Ribs (penultimate whorl) Minor	Remarks.
T. (Gazameda) acricula acricula	River Murray Cliffs	Lower Miocene	31	5·9	5·22	Moderately thick	5 (holotype) 2 3	6 7 8	Very turreted. Flattened whorls separate at suture in most adult shells.
T. (Gazameda) acricula adelaidensis	Abattoirs Bore	Upper Pliocene	30·6	6·2	4·61	Moderately thick	About 12, the medial ribs stronger generally than others.		Growth lines almost as strong as ribs, giving latticed appearance. Frequently very excavate at suture.
T. (Gazameda) acricula adelaidensis	Hallett's Cove	Upper Pliocene	30	6·5	4·51	Thick	1 0	If any, cannot be seen.	Thick, badly preserved shells.
T. (Gazameda) acricula victoriensis	Muddy Creek	Lower Miocene	24·3	5·6	4·34	Thin	0 1	c. 17 lirae	Thin, fairly smooth shells convex in early whorls.
T. (Gazameda) acricula victoriensis	Gippsland	Lower Pliocene	24·4	5·6	4·30	Fairly thick	3 2 0	Very variable most specimens presenting a pitted surface.	A great variety of ornamentation presented here. The typical spm. is strongly keeled and excavate at the suture.
T. (Gazameda) acricula victoriensis	Gelibrand River	Lower Miocene	23	5·4	4·25	Thin	0	c. 17	Similar to Muddy Creek.
T. (Gazameda) acricula tasmaniensis	Table Cape	Lower Miocene	36	8·5	4·23	Fairly thick	9 11 6	11 7 19	Fairly evenly sculptured, large, stout shells with major ribs numerous and evenly spaced.
T. (Gazameda) acricula victoriensis	Mornington	Balcombian	20·5	5·5	3·72	Thin	1 at suture	11 16	Much more convex, particularly in early whorls.

In general, the fossil specimens, where the protoconch and the early whorls can be seen, presents a stronger carination in the early whorls than the recent species, though the protoconchs are identical. The recent shell attains a greater size than the fossil, from which it appears to be a development. The Victorian representatives, from Muddy Creek and Mornington particularly, are distinct from those of other localities in the strong convexity of the whorls, particularly the early whorls. This is never developed in the Murray Cliffs series. The Victorian shells are far less attenuated, with a wider spire angle and less prominent sculpture, keels being absent for the most part. Those from Gippsland show characteristics midway between the two species; they are probably the strongest evidence for the development of *tasmanica* from *acricula*.

Table Cape specimens are strikingly stouter with more even, strongly developed lirae on the whorls.

Differences are presented also by specimens from the Abattoirs Bore, Adelaide.

We are therefore of the opinion that all the fossil specimens should be included in the species *T. acricula,* but that only those from the type locality, Murray Cliffs, are true *acricula*; the others we consider subspecies. The Victorian subspecies *T. acricula victoriensis* subsp. nov. is characterized by its less attenuated appearance and its convex whorls; the Tasmanian subspecies, *T. acricula tasmaniensis* subsp. nov. by its stouter size and more even and strongly lirate sculpture; for lack of better material we include the Hallett's Cove specimens with the Abattoirs Bore specimens, which are characteristic of the "grey-sand" bed passed through by many of the bores penetrating a depth of 300-500 feet in the neighbourhood of Adelaide. For this new subspecies possessing stout shell and strong tendency to excavation of the suture and bold sculpture, which is rather latticed, and not lirate we propose the name *T. acricula adelaidensis* subsp. nov.

It is obvious, then, that our division of subspecies is a geographical one only, made on the average characteristics exhibited by the shells from different localities. This seems the most likely division to prevent an endless confusion between the fossil and recent species.

DESCRIPTION OF SUBSPECIES OF *TURRITELLA ACRICULA* TATE.

1. *T. acricula acricula* Tate.

T. acricula Tate. Trans. Roy. Soc., S. Aust., xvii, p. 339, pl. viii, fig. 4.
Holotype. River Murray Cliffs. Tate Mus. Coll.

2. *T. acricula adelaidensis* subsp. nov.

Differs from *T. acricula s.s.* in having slightly more convex whorls, strong growth lines, and about 12 evenly-spaced and even-sized major ribs, giving a latticed appearance to the shell. Decidedly excavate at the suture.

Holotype. Length 37 mm., width 7 mm. Abattoirs Bore, 300-500 ft. Upper Pliocene. Tate Mus. Coll.

3. *T. acricula victoriensis* subsp. nov.

T. acricula var. Tate, Trans. Roy. Soc. S. Aust., xvii, p. 340, pl. ix, figs. 4, 7.

Holotype. Length 25 mm., width 5·5 mm. Gelibrand River, Lower Miocene. Tate Mus. Coll.

4. *T. acricula tasmaniensis* subsp. nov.

T. acricula var. Tate, Trans. Roy. Soc., S. Aust., xvii, p. 340, pl. ix, fig. 12.

Holotype. Length 34 mm., width 8·3 mm. Table Cape, Lower Miocene. Tate Mus. Coll.

TURRITELLA SUBACRICULA sp. nov.

Shell of medium size, sharply turreted, whorls convex, 14 whorls—protoconch missing. Sculptured with 4 major spiral ribs and indistinct secondary ribs crossed by marked axial striae of growth. Aperture strongly notched and quadrate. Columella straight; suture slightly impressed. Base finely spirally lirate and radially striate.

Holotype. Length 40·5 mm., width 7·8 mm. Abattoirs Bore 300-500 ft., Upper Pliocene. Tate Mus. Coll.

This shell is nearest to *T.* (*C.*) *acricula*, but differs greatly in the shape of the whorls and the strong sculpture.

CTENOCOLPUS Iredale 1925.

In *T.* (*Ctenocolpus*), genotype *T.* (*C.*) *australis* Lam., of which the subspecies *T.* (*C.*) *australis diffidens* Iredale seems scarcely separable from the species, should be placed *T. pagodula* Tate. *T. terebellata* Tate (noted as being like *T. pagodula*, but with the anterior keel nodulose; this together with the locality seems to validate the species), *T. curialis* Hedley, *T. joannae* Hedley, *T. mediopl'catilis* Chapman & Crespin, *T. gemmulata* Tate, *T.* (*C.*) *trilix* sp. nov., *T. warburtonii* T.-Wds., and *T. sturtii* T.-Wds.

TURRITELLA TRILIX sp. nov.

Shell small, acutely turreted, whorls flattened, suture slightly impressed. Whorls 10. Sculpture of 3 distinct major spiral ribs with wide, smooth interspaces; indistinct subsutural spiral between posterior major rib and suture. Aperture subquadrate; columella straight. Base finely spirally threaded. Protoconch of 1½ turns, smooth and oblique.

Holotype. Length 6·5 mm., width 2·5 mm. Abattoirs Bore 300-500 ft., Upper Pliocene. Tate Mus. Coll. Fairly numerous in bore.

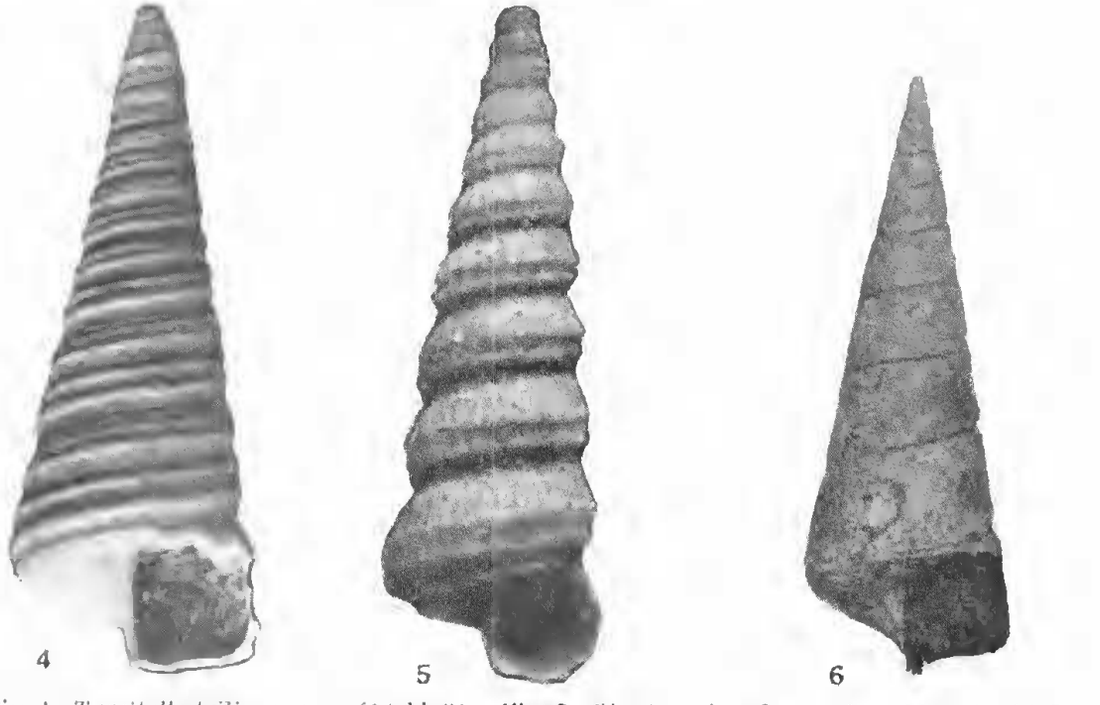

Fig. 4. *Turritella trilix* sp. nov. (× 11·3). Fig. 5. *Glyptozaria columnaria* sp. nov. (×16·7). Fig. 6. *Turritella latissima* sp. nov. (nat. size).

TURRITELLA WARBURTONI Tenison-Woods.

Tenison-Woods, Proc. Roy. Soc. Tas. 1876, p. 99.

Tate, Trans. Roy. Soc., S. Aust., xvii, p. 337, pl. viii, fig. 2.

TURRITELLA STURTII Tenison-Woods.

Tenison-Woods, Proc. Roy. Soc. Tas. 1876, p. 99.

Tate, Trans. Roy. Soc., S. Aust., xvii, p. 338, pl. viii, fig. 6.

These two species are separable with some difficulty, and Pritchard has suggested (7) that the names are synonymous. To us, however, the differences are striking enough to warrant the retention of both species as distinct. Tate's redescription of Woods's species raises some doubt as to whether he had correctly

(7) Proc. Roy. Soc., Vic., viii, n.s., pp. 113-114.

identified the species with which he was dealing, but after careful examination of the tablets in the Tate collection, and specimens from the collection of Mr. F. A. Singleton, we conclude that certain features pointed out in both descriptions should be more closely adhered to than other less uniform characteristics.

Tate has on his tablet a small shell of *T. warburtonii* marked "like type" from which we conclude that Tate had seen the type and selected a topotype as near to the holotype as possible. His own description is of a more adult shell. We take this to confirm our decision that Tate is not describing a different shell

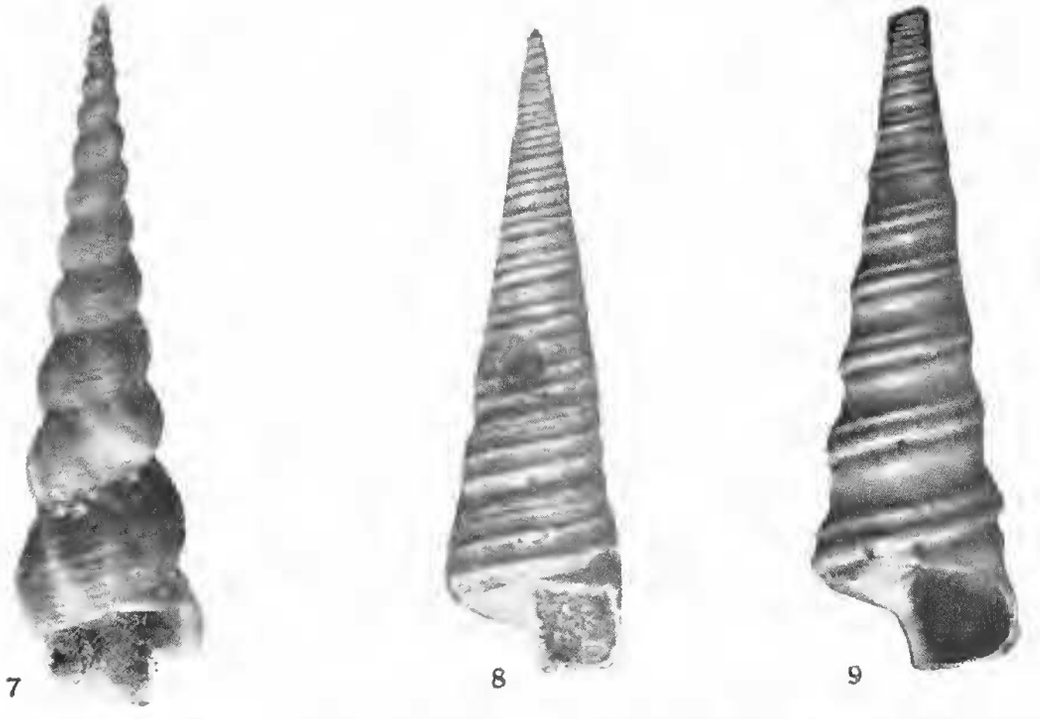

Fig. 7. *Turritella terebra occidua* subsp. nov. (× 3·5). Fig. 8. *Turritella sturtii* Tenison Woods (× 5·9). Fig. 9. *Turritella warburtonii* Tenison Woods (× 6).

when he mentions "two anterior ribs more or less granulose", though Tenison-Woods emphasized that there were "two *smooth* conspicuous ribs at the lower part of each whorl"; in the juvenile shells the ribs are less granulose, and may be even smooth though an obscure (certainly not strong) granulation develops later.

The main features that distinguish the two shells are these; we merely stress what has been already described by Tenison-Woods and Tate:

T. warburtonii is narrowly pyramidal, *T. sturtii* acutely so.

T. warburtonii is characterized by the strong development of two ribs in the anterior portion of each whorl—in the best-developed specimens, these ribs are keel-like, giving an almost pagodoid appearance to the shell.

T. warburtonii has a distinct constriction, a concavity in the most strongly-developed specimens, in the posterio-medial part of the whorl; this is presumably the flattening of Tenison-Woods's description.

While some of the examples from Mr. Singleton's collection show tendencies mid-way between the two species, by paying close attention to the shape of the shell and the development of the anterior ribs, we have without hesitation placed them in one or the other of the species.

The following remarks are extracts from Mr. Singleton's own notes, very kindly offered to us, and our comments upon the specimens under observation. Mr. Singleton's note precedes ours in each case, and the numbers are those from his catalogue:

No. 478—Two smooth ribs and finer lirae. From Lower or "*Crassatella*" bed.

In spite of their apparent *warburtonii* characteristics we place these acutely pyramidal shells, lacking in strong keel-like development, in *T. sturtii*.

No. 479—2 strong, 2 small ribs, former granulose.

These shells resemble both species in some ways, but are sufficiently strong in the anterior ribs and have sufficient posterio-medial constriction to place them in *T. warburtonii*.

No. 480—5-6 ribs, of which median 2-3 granulose.

These are *T. sturtii*.

No. 481—2 ribs, anterior and median, latter granulose, plus lirae.

These are *T. warburtonii*.

No. 482—2 granulose ribs, plus lirae.

These are *T. warburtonii*.

No. 483—2 anterior, very prominent ribs, second slightly granulose, close together, posterior lirate, concave.

These are *T. warburtonii*.

No. 484—2 anterior granulose ribs, weak rib posteriorly.

These are *T. warburtonii*.

No. 485—3 ribs, 2 anterior granulose, third a keel anterior to suture, plus lirae.

These are separable into the two species; 3 specimens lacking strong ribs in the anterior portion we place in *T. sturtii*, the remainder with keel-like outline we assign to *T. warburtonii*.

No. 486—3 ribs, 2 anterior granulose, plus lirae.

Two ribs are so much more strongly developed than the third, which is situated close to the posterior border, and the general outline of the shell place them in *warburtonii*.

Nos. 479-486 are from Upper or "Turritella" bed.

A perusal of these notes convinces one of the almost complete coincidence between Mr. Singleton's notes and our division; all the shells, with the exception of 478, which has weaker, more widely-spaced ribs, that have 2 prominent ribs, fall into *T. warburtonii*; all those more than 2 ribs, except where the anterior pair are very strongly developed, go into *T. sturtii*.

COLPOSPIRA Donald 1900.

In this sub-genus are included *T. runcinata* Watson (genotype), *T. sinuata* Reeve, *T. cardismei* Watson, *T. accisa* Watson, *T. aldingae* Tate, *T. conspicabilis* Tate, *T. tristira* Tate, *T. acinella* Chapman and Crespin, *T. platyspira*, T.-Wds.

TURRITELLA ACCISA Watson.

This species has been correctly recorded by Watson (8), May (9), Vereo (10), and Cotton and Godfrey (11) from Bass Strait, South Australia, and Tasmania, all from depths of 38-200 fathoms, and specimens we have examined are typical and distinct from *T. runcinata* occurring in the same localities.

Among the specimens from 100 fathoms off Cape Pillar in the May Collection is a typical specimen of *T. runcinata* which can therefore be added to the Tasmanian list.

TURRITELLA TRISTIRA Tate.

T. tristira Tate. Proc. Roy. Soc., Tas., 1884, p. 227.

T. tristira Tate, Trans. Roy. Soc., S. Aust., xvii (iv), p. 338-339, pl. viii, fig. 8; pl. x, fig. 3.

Some difficulty has been experienced in the differentiation of *T. tristira* from *T. conspicabilis*. The two species exhibit characteristics so closely approximating that unless some rigid distinguishing feature is selected, this difficulty will always arise so long as the two are considered separate species.

The holotype is a Table Cape shell in the Tate Museum Collection, and is, in our opinion, the only one in the collection that can be accurately related to the species. All other specimens on the tablet marked *Turritella tristira* we consider would be better classified under *T. conspicabilis*. On examining the tablets in the Tate Collection one cannot help noticing the apparent indifference with which he separates the two.

(8) Journ. Linn. Soc., Zool., xv, 188, p. 220.

(9) Check list of Mollusca of Tasmania, 1921, p. 60.

(10) Trans. Roy. Soc., S. Aust., xxxiv, 1910, pp. 122-123.

(11) S. Aust. Nat., xii, (iv), August, 1931, p. 57.

There are, however, sufficient specimens available, one from the collection of Mr. F. A. Singleton taken at Jemmy's Point, Kalimna, and many which one of us (N.H.W.) has seen in the collection of the Commonwealth Palaeontologist, taken from various borings in the Gippsland area, to justify the retention of the species. In all cases, the characteristic keeling is continued in every whorl towards the apex. The holotype, so far as can be seen, for the early whorls are missing, exhibits this feature, which makes any similar specimens easily recognizable from *T. conspicabilis*.

We therefore recommend the use of *Turritella tristira* only for those examples in which the development of three even keels is regularly produced throughout the whole of the shell. This is in full agreement with Tate's original description:

"Shell acuminately turreted; apical angle about 15° of upwards of 12 slightly convex whorls; suture linear. Surface ornamented with three conspicuous, spiral, acute ribs and spiral and transverse striae; the sulci on each side of the central rib are of equal breadth, but the anterior rib is separated from the suture by a distance less than that which separates one rib from the next, whilst the posterior rib is separated from its corresponding suture by a distance greater than the breadth of the medial sulci. Last whorl truncately angular at the periphery; base spirally ribbed and striated. Aperture quadrate; outer lip imperfect.

Length 45 mm., breadth 12 mm.

Locality. Table Cape. R. M. Johnston (one example).

This species is distinct from the few living species which are conspicuously three-ribbed, by shape, ornament, and the unsymmetrical position of the revolving keels."

PLATYCOLPUS Donald 1900.

In this subgenus are included *T. quadrata* Donald (genotype), *T. guillaumei* Iredale, *T. scitula* Donald, *T. circumdigata* Vereo, and *T. mediolevis* Vereo. Iredale refers the last two to *Colpospira*, but this is surely wrong, the apex being quite different. He speaks of the genus as having a weak sinus, while his own and Vereo's figures show a strong one. Finlay's specimens of *T. guillaumei* and *T. quadrata* show quite a valid notch.

The embryonic and subsequent development is entirely different from that of *Colpospira* with which this series appears to have no relation. On the other hand, *Platycolpus* seems to be closely allied to *Ctenocolpus*, the only features of difference mentioned by Iredale are the nodulod keels and weak sinus of *Ctenocolpus*. Nodulling of the spirals arises irregularly in many Turritellas.

GLYPTOZARIA Iredale 1924.

This genus with *T. opulenta* Hedley as genotype includes the fossil *T. transenna* Tenison-Woods which Tate ([12]) referred to *Mathilda* and *Glyptozaria columnaria* here described as new:

GLYPTOZARIA COLUMNARIA sp. nov.

Shell turreted, whorls 10, protoconch depressed, of 1½ globose whorls, adult whorls regularly convex, sculptured with 2 keels on each whorl, the body whorl showing an extra rib at the anterior, crossed by numerous less valid axial ribs, about 24 on the body whorl. Base smooth, aperture rounded, with 3 flutes corresponding with ribs; outer lip rounded, slightly effuse at the base of the columella, which is straight. Suture slightly canalienlate. Animal unknown.

Holotype. Length 4·5 mm., width 1·5 mm.; 100 fathoms. Cape Pillar. Reg. No. D 11438 S.A. Museum.

PAREORA Marwick 1931.

Pareora Marwick 1931, N.Z. Geol. Soc., Pal. Bull., xiii, p. 94.

Here, with genotype *Eglisia striolata* Hutton, we place *Mesalia stylacris* Tate, the polygyrate protoconch and aperture continuous with the concave columella being consistent with the genus.

LIST OF NEW NAMES INTRODUCED IN THIS PAPER:

Turritella terebra occidua subsp. nov.
Kimberia subgen. nov. for *Turritella kimberi* Verco.
Turritella murrayana subrudis subsp. nov.
Turritella latissima sp. nov.
Turritella acricula adelaidensis subsp. nov.
Turritella acricula victoriensis subsp. nov.
Turritella acricula tasmaniensis subsp. nov.
Turritella subacricula sp. nov.
Turritella trilix sp. nov.
Glyptozaria columnaria sp. nov.

NEW LOCALITIES FOR *TURRITELLA SPP.*

T. runcinata juvs. Hopetoun, W.A.
T. accisa. Hopetoun, 30 fathoms.

([12]) Trans. Roy. Soc., S. Aust., xvii, p. 335.

T. accisa, numerous. 81 fathoms, 80 m. W. of Eucla.
T. accisa, 50-120 fathoms. Great Australian Bight. W. of Eucla.
T. iredalei. Esperance, W.A.
T. smithiana, 300 fathoms, 120 m. W. of Eucla.

LIST OF AUSTRALIAN TURRITELLIDAE MENTIONED IN THIS PAPER:

TURRITELLA Lamarck 1799.

Mem. Soc. H. Nat. Paris, p. 74.
Genotype (by Monotypy) *Turbo terebra* Linn.

1. *Turbo terebra* Linn. 1758. Syst. Nat. ed. 10, p. 766.
2. *Turritella terebra occidua* Cotton and Woods, 1935.

Subgenus KIMBERIA Cotton and Woods.

Genotype (by original designation) *T. kimberi* Verco.

3. *Turritella kimberi* Verco 1908, Trans. Roy. Soc., S. Aust., xxxii, p. 342, pl. xv, fig. 14-15. 20 fath. Backstairs Passage, S.A.
4. *Turritella neptunensis* Verco 1910, *Ibid.* xxxiv, p. 120, pl. xxx, fig. 7. 104 fath. 35 miles S.W. of Neptune Is., S.A.
5. *Turritella microscopica* May, 1911. Proc. Roy. Soc., Tas., 1910, p. 395. pl. xv, fig. 23.

Subgenus MAORICOLPUS Finlay, 1926.

Trans. N.Z. Inst., lvii, p. 389. Genotype (by original designation) *T. rosea* Q. & G.

6. †*Torcula murrayana* Tate, 1885. Proc. Roy. Soc., Tas., 1884, p. 227, Trans. Roy. Soc., S. Aust., xvii, 1893, p. 340, pl. viii, fig. 3. River Murray Cliffs, Lower Miocene.
7. †*Turritella murrayana subrudis* Cotton and Woods, 1935. Abattoirs Bore, Upper Pliocene.
8. †*Turritella latissima* Cotton and Woods, 1935. Table Cape, Lower Miocene.

Subgenus STIRACOLPUS Finlay, 1926.

Trans. N.Z. Inst., lvii, p. 389. Genotype (by original designation) *T. symmetrica* Hutton.

9. *Turritella godeffroyana* Donald, 1900, Proc. Mal. Soc., iv, No. 2, p. 53, pl. v, fig. 6, 6a. Bass Strait.
10. *Turritella smithiana* Donald, 1900, *Ibid.*, p. 52, pl. xv, fig. 1. Off Sydney, 410 fath.

11. *Turritella atkinsoni* Tate and May, 1900, Trans. Roy. Soc., S. Aust., xxiv, p. 95. New name for *T. tasmanica* T-Wds., 1876, Proc. Roy. Soc., Tas., 1875, p. 140, *non* Reeve 1849. Also Tate and May, 1901 (Dec.), Proc. Linn. Soc., N.S.W., xxvi, 3, p. 378, pl. xxiii, fig. 15-17. Long Bay, Tasmania. Synonym *T. tasmaniensis* (T.-Wds.), Tate and May, 1900 (Dec.), *loc. cit.*, quoted as equivalent name to *T. tasmanica*.
12. *Turritella medioangulata* Verco 1910, Trans. Roy. Soc., S. Aust., xxxiv, p. 125, pl. xxx, fig. 8, 9. 104 fath. 35 miles S.W. of Neptune Is., S.A. A closely allied species regarded by Verco as a variety of *T. atkinsoni*.

Subgenus GAZAMEDA Iredale, 1924.

Proc. Linn. Soc., N.S.W., xlix (iii), 1924, p. 247.

13. *Turritella gunnii* Reeve, 1849, Conch. Icon., v, pl. ix, fig. 45. Synon, *T. philippensis* Watson 1881, Journ. Linn. Soc., xv, p. 223, Chall. Rep. Zool., xv, p. 479, pl. xxx, fig. 6, 35 fath. Port Phillip.
14. †*Turritella septifraga* Tate 1893, Trans. Roy. Soc., S. Aust., xvii, 1893, p. 336, pl. xviii, fig. 5. Spring Creek, Janjukian.
15. †*Turritella acricula acricula* Tate, 1893, *Ibid.* p. 339, pl. viii, fig. 4. River Murray Cliffs, Lower Miocene.
16. †*Turritella acricula adelaidensis* Cotton and Woods, 1935. Abattoirs Bore, Adelaide, Upper Pliocene.
17. †*Turritella acricula victoriensis* Cotton and Woods, 1935. *Turritella acricula* var. Tate, Trans. Roy. Soc., S. Aust., xvii, 1893, p. 340, pl. ix, fig. 4, 7.
18. †*Turritella acricula tasmaniensis* Cotton and Woods, 1935. *Turritella acricula* var. Tate, Trans. Roy. Soc., S. Aust., xvii, 1893, p. 340, pl. ix, fig. 12.
19. †*Turritella subacricula* Cotton and Woods, 1935.
20. *Turritella tasmanica* Reeve, 1849, Conch. Icon., v, pl. ix, fig. 42. Van Diemen's Land. Synon. *Turritella subsquamosa* Dunker, 1871, Mal. Blatt., xviii, p. 152. Bass Strait. *Turritella acuta* Tenison-Woods, 1876, Proc. Roy. Soc., Tas., 1876, p. 143. Long Bay, Tasmania. *Turritella lamellosa* Watson, 1881, Journ. Linn. Soc. Zool., xv, p. 229, Chall. Rep. Zool., xv, 1886, p. 474, pl. xxix, fig. 6. 40 fath., off East Moncoeur Is., Bass Strait. *Turritella oxyaeris* Tate 1897, Trans. Roy. Soc., S. Aust., xxi, 1897, p. 41; new name for *T. acuta* T.-Wds., *non* Mayer, 1859.
21. *Gazameda iredalei* Finlay 1927, Trans. N.Z. Inst., lvii, p. 496. New name for *T. clathrata* Kiener, 1843, Icon. Coq. Viv., 38, pl. xiv, fig. 1, *non* Deshayes 1833 "Shores of New Holland" (S.A.).
22.† *Turritella multicincturalis* Chapman and Crespin, 1928, Rec. Geol. Surv., Vic., v, 1, p. 116, pl. viii, fig. 46. Sorrento Bore, 741 ft. (Kalimnan).

Subgenus CTENOCOLPUS Iredale, 1928.

Rec. Aust. Mus., xiv, 4, p. 266. Genotype (by original designation) *T. australis* Lamarck.

23. *Turritella australis* Lamarck, 1822. An. S. Vert., vii, p. 59; also Kiener 1843, Coq. Viv. 36, pl., fig. 3. Synon. *T. granulifer* T.-Wds., 1876, Proc. Roy. Soc., Tas., 1875, p. 142. Port Arthur, Tasmania.
24. †*Turritella pagodula* Tate, 1893, Trans. Roy. Soc., S. Aust., xvii, p. 336.
25. †*Turritella terebellata* Tate, 1893, Trans. Roy. Soc., S. Aust., xvii, p. 336. Limestone Creek, Glenelg River (Werrikooian). Noted as being like *T. pagodula* but with anterior keel nodulose; this, together with the locality, seems to validate the species.
26. *Turritella curialis* Hedley, 1907, Rec. Aust. Mus., vi, 5, p. 357, pl. lxvii, fig. 19. 800 fath. 35 miles east of Sydney.
27. *Turritella joannae* Hedley, 1923, Proc. Linn. Soc., N.S.W., xlvii, 3, p. 311. New name for *T.* (*Colpospira*) *crenulata* Donald, 1900, Proc. Mal. Soc., iv, 2, p. 52, pl. v, fig. 26, *non* Nyst, 1843. Synon. *Turritella reevi* Cossman, 1912, Ess. Pal. Comp. ix, p. 119, *non* Dautz and Fisher, 1907; new name for *T. crenulata* Donald.
28. †*Turritella medioplicatilis* Chapman & Crespin, 1928, Rec. Geol. Surv. Vict., v, 1, p. 116, pl. viii, fig. 47. 1,461 ft. Sorrento Bore (Balcombian).
29. †*Turritella warburtonii* Tenison-Woods, 1876, Proc. Roy. Soc., Tas., 1876, p. 99; Tate, Trans. Roy. Soc., S. Aust., xvii, 1893, p. 337, pl. viii, fig. 2 (topotype). Table Cape, Tasmania (Lower Miocene).
30. †*Turritella sturtii* Tenison-Woods, 1876, Proc. Roy. Soc., Tas., 1876, p. 99; Tate, Trans. Roy. Soc., S. Aust., xvii, 1893, p. 338, pl. viii, fig. 6 (topotype).

Subgenus COLPOSPIRA Donald, 1900.

Proc. Mal. Soc., iv, 2, p. 51. Genotype (by original designation) *T. runcinata* Watson.

31. *Turritella runcinata* Watson, 1881, Journ. Linn. Soc., Zool., xv, p. 218, Chall. Rep. Zool., xv, p. 475, pl. xxx, fig. 3. 38-40 fath. East Moncoeur Is., Bass Strait. *Torcula tenuilirata* Dunker, 1869, Mus. Godeff., Cat. 4, p. 77, No. 3433; *Nomen nudum*. Bass Strait. *Murchisoni sutoris* Dunker, 1874, *ibid.* 5, p. 148, substitute name for *T. tenuilirata* referred to *Zaria* on p. 212. Name validated as a synonym of *runcinata* by Donald 1900, Proc. Mal. Soc., iv, 2, p. 50. *Turritella higginsi* Petterd, 1884, Journ. Conch., iv, p. 135. Tamar Heads, Tasmania.

32. *Turritella accisi* Watson, 1881, Journ. Linn. Soc., Zool., xv, p. 220, *Ibid.* 1886, p. 476, pl. xxxi, fig. 4.
33. *Turritella sinuata* Reeve 1849, Conch. Icon., v, pl. ix, fig. 62. *Turritella incisa* Tenison-Woods, 1878, Proc. Linn. Soc., N.S.W., 4, p. 262. Iredale, 1925, Rec. Aust. Mus., xiv, 4, p. 267, pl. xliii, fig. 23. *Turritella sophiae* Brazier, 1883, Proc. Linn. Soc., N.S.W., viii, p. 227; new name for *T. incisa* T.-Wds., *non* Reeve, 1849.
34. *Turritella cordismei* Watson 1881, Journ. Linn. Soc., Zool., xv, p. 224, Chall. Rep., Zool., xv, 1886, p. 469, pl. xxix, fig. 1. 38-40 fath. East Maneoeur Is., Bass Strait.
35. †*Turritella platyspira* Tenison-Woods, 1879, Proc. Linn. Soc., N.S.W., iii, p. 234, pl. xx, fig. 13. Muddy Creek Lr. (Balcombian).
36. *Turritella acinella* Chapman and Crespin, 1928, Rec. Geol. Surv., Vic., v, 1, p. 115, pl. viii, fig. 45. 1,310 ft. Sorrento Bore (Balcombian).
37. †*Turritella aldingae* Tate 1882, Trans. Roy. Soc., S. Aust., v, 42; *ibid.* Dec., xvii, 1893, p. 336, pl. viii, fig. 1. Aldinga, S.A. (Janjukian).
38. †*Turritella conspicabilis* Tate, 1893, Trans, Roy. Soc., S. Aust., xvii, p. 339, pl. viii, fig. 7. Gippsland Lakes (Kalimnan).
39. †*Turritella tristira* Tate, 1884, Proc. Roy. Soc., Tas., 1884, p. 227, Trans. Roy. Soc., S. Aust., xvii, 1893, p. 338, pl. viii, fig. 8. Table Cape, Tasmania (Lower Miocene).

Subgenus PLATYCOLPUS Donald, 1900.

Proc. Mal. Soc., iv, 2, p. 53. Genotype (by original designation) *T.* (*Colpospira*) *quadrata* Donald.

40. *Turritella* (*Colpospira*) *quadrata* Donald, 1900, Proc. Mal. Soc., iv, 2, p. 53, pl. v, fig. 8-8b. 45 fath. Bass Strait.
41. *Colpospira guillaumei* Iredale, 1924, Proc. Linn. Soc., N.S.W., xlix, 3, p. 248, pl. xxxvi, fig. 4, 15. 5-10 fath. Twofold Bay, N.S.W.
42. *Turritella circumligata* Verco, 1910, Trans. Roy. Soc., S. Aust., xxxiv, p. 123, pl. 30, fig. 3, 4. 110 fath. Beachport, S.A.
43. *Turritella mediolevis* Verco 1910, Trans. Roy. Soc., S. Aust., xxxiv, p. 121, pl. xxx, fig. 5-6. 62 fath. Cape Borda, S.A.
44. *Turritella quadrata* var. *scitula* Donald, 1900, Proc. Mal. Soc., iv, 2, p. 54, pl. v, fig. 9.

GLYPTOZARIA Iredale, 1924.

Proc. Linn. Soc., N.S.W., xlix, 3, p. 248. Genotype (by original designation) *T. opulenta* Hedley.

45. *Turritella opulenta* Hedley, 1907, Rec. Aust. Mus., vi, 4, p. 292, pl. lxv, fig. 9. 41-50 fath. Cape Three Points, N.S.W.
46. †*Turritella transenna* Tenison-Woods, 1879, Proc. Linn. Soc., N.S.W., iii, p. 234, pl. 20, fig. 8. Muddy Creek (Balcombian); Tate Trans. Roy. Soc., S. Aust., xvii, p. 335.
47. *Glyptozaria columnaria* Cotton and Woods, 1935.

Genus PAREORA Marwick, 1931.

N.Z. Geol. Soc. Pal. Bull., xiii, p. 94. Genotype (by original designation) *Eglisia striolata* Hutton.

48. †*Masalia stylacris* Tate, 1893, Trans. Roy. Soc., S. Aust., xvii, p. 341, pl. ix, fig. 3. Aldinga, S.A. (Janjukian).

† Fossil.